

Remarks

Claims 3 and 16 have been canceled. Claims 1-2, 4-15, 17-21 and new claims 22-23 remain.

Applicants acknowledge the Examiner's allowance of claims 3 and 16. Claims 3 and 16 have been incorporated into independent claims 1 and 9, respectively, and re-phrased as suggested by the Examiner to overcome the objection under 37 CFR §1.75(a). Thus all of claims 1-2, 4-15 and 17-21 are now believed allowable.

New claims 22-23 have been added. Independent claim 22 is directed to a *current-perpendicular-to-the-plane (CPP)* magnetoresistive read head that requires a *substantially-chemically-ordered AuCu alloy having a tetragonal crystalline structure and a thickness between about 10 and 200 Angstroms* in contact with a *substantially-chemically-ordered PtMn alloy having a tetragonal crystalline structure and a thickness less than approximately 125 Angstroms*. Dependent claim 23 further limits the thickness of the PtMn alloy *to between about 25 and 50 Angstroms*.

These new claims are allowable, as will be explained. As the Examiner correctly points out in the Office Action, Fukuzawa et al (US 2002/0048690) fails to specifically disclose that “the thickness of the PtMn alloy antiferromagnetic layer is less than approximately 125 Angstroms” and that “the thickness of the AuCu underlayer is between approximately 10 and 200 Angstroms.” Also, as the Examiner correctly points out, it is well known that thickness ranges are considered to be within the level of ordinary skill in the art and the applicant must show that the particular range is critical, generally by showing that the claimed range achieves unexpected results relative to the prior art range, citing *In re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990). In this regard, the specification clearly explains the unexpected criticality of the thickness ranges for a *CPP read head*. The problem is stated at page 3, lines 20-23:

In CPP sensors, *the large thickness of the PtMn antiferromagnetic layer is a disadvantage* because the high resistivity of PtMn reduces the sensor magnetoresistance (the $\Delta R/R$ measurable by the sensor) for a given sense current, or requires that a relatively high sense current be used in the sensor to achieve the desired magnetoresistance.

The specification further states (page 6, line 29 to page 7, line 10) that in the prior art the PtMn is required to be at least 150 Angstroms thick to achieve its antiferromagnetic property, but that as a result of annealing in contact with a AuCu underlayer, its thickness can unexpectedly be reduced to 50 Angstroms:

In the preferred embodiment the antiferromagnetic layer is *chemically-ordered equiatomic Pt₅₀Mn₅₀ located on and in direct contact with an underlayer of chemically-ordered equiatomic Au₅₀Cu₅₀*. The two layers are deposited by magnetron or ion-beam sputtering. After all the layers in the sensor are deposited the sensor is subjected to annealing for 4 hours at 250 °C. *As a result of thermally-activated atomic diffusion, the AuCu underlayer transforms to the L1₀ phase and helps the PtMn with which it is in contact to also transform to the L1₀ phase. When formed on a AuCu underlayer having a thickness between approximately 10 and 200 Å, the PtMn layer can be as thin as 50 Å, preferably in the range of 25 to 50 Å, and still transform to the L1₀ phase and thus generate the required exchange-bias in the antiferromagnetic layer. When the PtMn is formed on a conventional underlayer, such as Ta or NiFeCr, it is required to be approximately 150 Å thick.*

It is important to note that Fukazawa does not relate to CPP read heads and is directed solely to *CIP read heads*, as is apparent from Fig. 10. Thus not only does Fukuzawa not teach or suggest any unexpected reduction in thickness of PtMn when used with a AuCu underlayer, there is no motivation for Fukuzawa to reduce the PtMn thickness because there would be *no benefit in doing so in a CIP head*. Thus, there is no validity to the argument that in view of Fukuzawa, which relates to CIP heads and which teaches no thickness ranges for a PtMn antiferromagnetic layer in contact with a AuCu underlayer, it would be obvious to select the reduced thickness ranges for a CPP head as claimed by Applicants in new claims 22-23.

In view of the above amendments and comments Applicants believe all remaining claims are in condition for allowance. The Examiner is invited to call Applicants' attorney if a telephone conference will expedite the prosecution of this application.

Respectfully submitted,

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